

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
WALDEN POND OUTLET DA. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV AUG 78

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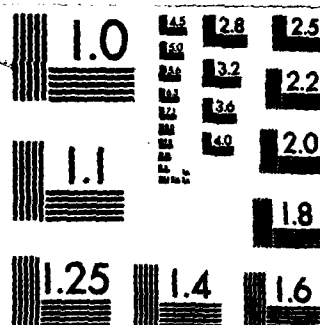
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**COASTAL BASIN
SAUGUS, MASSACHUSETTS
LYNN, MASSACHUSETTS**

WALDEN POND OUTLET DAM

MA 00246

WALDEN POND EAST END DAM

MA 00235

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**



**DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02154**

AUGUST 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Coastal Basin Penny Brook Saugus, Massachusetts Lynn, Massachusetts		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Both dams are earthfill with concrete fore. The Walden Pond east Dam is about 180 ft. long and about 12 ft. high. The other contains a 6 ft high by 30 ft long ungated spillway near its north end. The Walden Pond Outlet Dam is considered to be in poor condition. The situation on the East End Dam is not as severe but is considered to be in fair condition. Both are intermediate in size and classified as having a high hazard potential. Additional investigations or major modifications are not necessary.		

WALDEN POND OUTLET DAM

MA 00246

WALDEN POND EAST END DAM

MA 00235

COASTAL BASIN

SAUGUS, MASSACHUSETTS

LYNN, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: MA 00246
Name of Dam: Walden Pond Outlet
Town: Saugus, Massachusetts
County and State: Essex County, Massachusetts
Stream: Penny Brook
Date of Inspection: July 6, 1978

Identification No.: MA 00235
Name of Dam: Walden Pond East End
Town: Lynn, Massachusetts
County and State: Essex County, Massachusetts
Stream: None
Date of Inspection: July 7, 1978

BRIEF ASSESSMENT

The Walden Pond Outlet Dam was originally constructed in 1890. It was raised in 1905 when the Walden Pond East End Dam was constructed. Both dams are earthfill with concrete core. The former is 2,190 feet long and 42 feet high; the latter 180 feet long and about 12 feet high. The Walden Pond Outlet Dam contains a 6-foot high by 30-foot long ungated spillway near its north end. The reservoir is part of the City of Lynn water supply system. Walden Pond receives water from Hawkes Pond and discharges water to both Birch and Breed Ponds.

Owing primarily to severe erosion caused by motorbikes, and the partial exposure of the concrete core wall, the Walden Pond Outlet Dam must be

considered in poor condition. The situation on the East End Dam is not as severe and this dam can be considered to be in fair condition. The spillway structure is overgrown and contains debris.

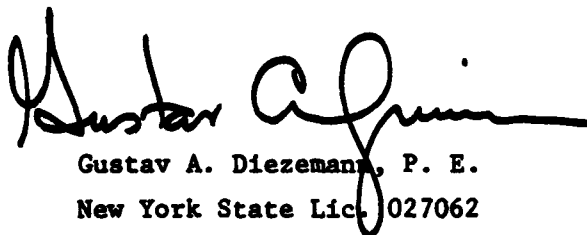
The impounded volume of the reservoir, 4,100 acre feet, places the dams in the intermediate size classification. The dams are both in the high hazard potential category and thus hydraulically analyzed using the full probable maximum flood.

Reservoir storage will reduce the maximum probable discharge of 1,411 cfs to a test flood of 642 cfs. As the spillway can discharge this test flood with approximately 2 feet of freeboard remaining, the chance of the dam overtopping is considered minimal.

A failure of the Walden Pond Outlet Dam could produce a flow as high as 184,000 cfs; a failure of the East End Dam a flow of 4,200 cfs. Failure flows of these magnitudes would cause destruction of dwellings and other property in the watercourses below the dams and would endanger human life.

Additional investigations or major modifications are not necessary. Remedial measures that should be implemented by the owner within one year after receipt of this Phase I Inspection Report are described in Section 7. Although the dam is in no danger of overtopping, and the crest width is larger than the height of the dam, the erosion on the downstream slope and the exposure of the core can only increase. These areas should be repaired and every effort made to keep the situation from again deteriorating.

The owner should institute a regular program of inspection and maintenance and should develop a flood warning system.


Gustav A. Diezemann, P. E.
New York State Lic. 027062

This Phase I Inspection Report on the Walden Pond Outlet Dam and the Walden Pond East End Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

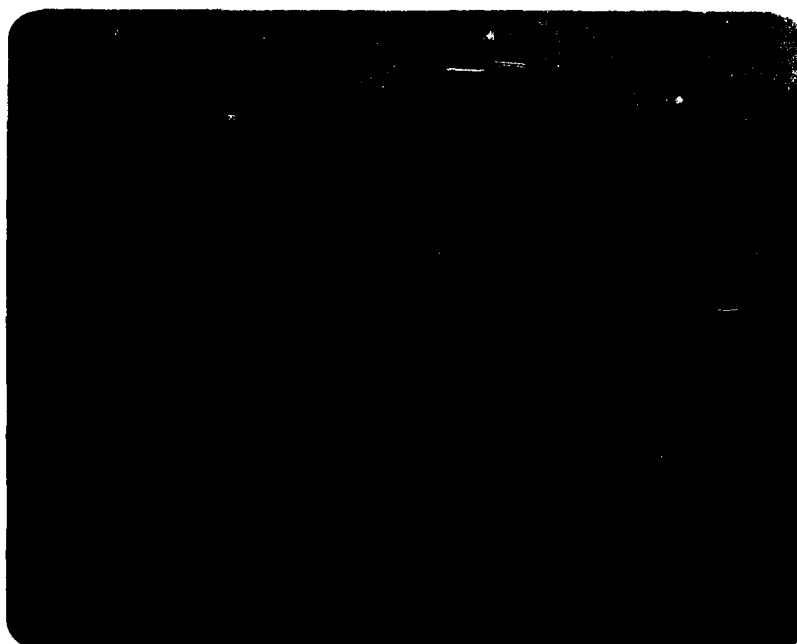
In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection, along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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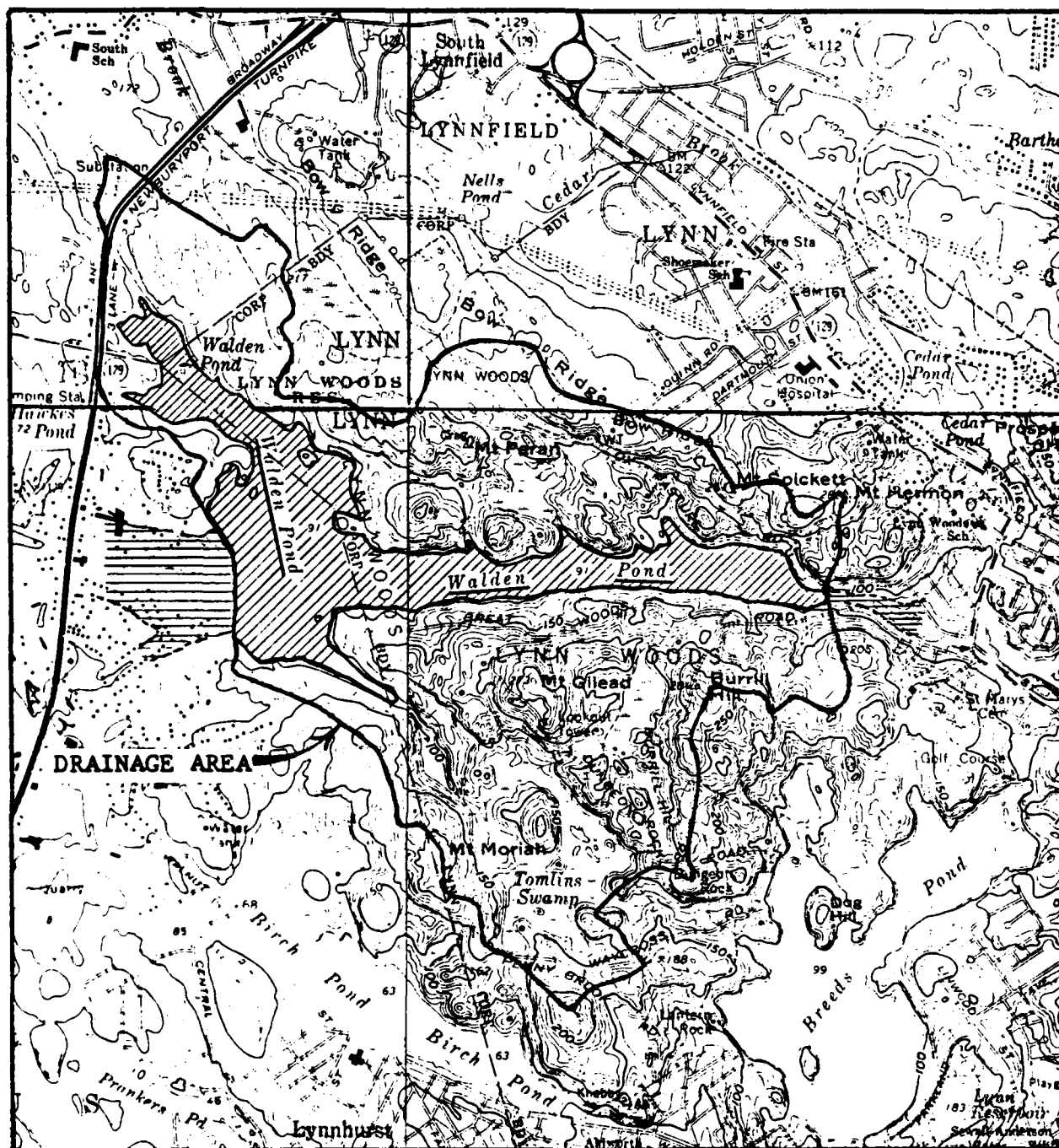
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OVERVIEW PHOTO



OVERVIEW PHOTO



WALDEN POND OUTLET AND WALDEN POND EAST

READING, BOSTON NORTH: SALEM and LYNN, MASS.
Scale 1:24000

PHASE I INSPECTION REPORT

WALDEN POND OUTLET

WALDEN POND EAST END DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-D328 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The Walden Pond Project is located in Essex County, Massachusetts. The Walden Pond Outlet is located in the Town of Saugus. The Walden Pond East End dam is in the City of Lynn.

b. Description of Project. The Walden Pond Outlet dam was constructed in 1890 and raised in 1905 when the East End dam was constructed. The Outlet dam is about 2,190 feet long and 42 feet high; the East End dam is 180 feet long and appears to be about 12 feet high. The spillway at the Outlet, built in 1930, is 30 feet wide by 6 feet deep. Also at the Outlet

is a gate house controlling gravity feed to Birch Pond, and an emergency blowoff arrangement which can be directed either to Birch Pond or the watercourse below the dam. Walden Pond receives pumped water from Hawkes Pond. At the East End is a 16.5 mgd pumping station which pumps water to Breeds Pond. Under certain water level conditions, this 36-inch line flows by gravity.

c. Size Classification. Owing to the impoundment of approximately 4,100 acre feet below the crest, the dams fall within the intermediate size classification.

d. Hazard Classification. The areas downstream of the dams which would be endangered if the dams failed are urban or, at best, suburban in nature. The dams are considered to have high hazard classification.

e. Ownership. The dams are owned by the City of Lynn.

f. Operator. Mr. Patrick McGrath, Superintendent of Water, Department of Public Works, Lynn, Massachusetts, (617) 592-7900, Ext. 242.

g. Purpose of Dams. The reservoir impounded by the dams is a part of the City of Lynn's water supply system.

h. Design and Construction History. Other than a drawing, excerpts which are a part of this report, nothing is known of the design and construction history of this project.

i. Normal Operating Procedures. The water level is normally kept below the spillway level by means of releases to Birch Pond. Inflows exceeding outflow and storage capabilities would discharge through the spillway.

1.3 Pertinent Data

a. Drainage Area. Walden Pond has an approximate 1.75 square mile drainage area of semi-wooded, hilly land.

b. Discharge at Damsite.

(1) The outlet works consist of a 36-inch gravity line to Birch Pond and an emergency blowoff arrangement which can be directed either to Birch Pond or Hawkes Brook.

(2) The maximum known flood at the site is unknown.

(3) The ungated spillway capacity exceeds the test flood of 642 cfs.

(4) There is no gated spillway capacity.

(5) There is no gated spillway capacity.

of 642 cfs. (6) The total spillway capacity exceeds the test flood

c. Elevation (Feet Above MSL)

(1)	Top of dam	El. 97 \pm (both dams)
(2)	Maximum design surcharge	El. 95 \pm (both dams)
(3)	Full flood control pool	N/A
(4)	Recreation pool	N/A
(5)	Spillway crest (ungated)	El. 91 \pm (Outlet dam)
(6)	Upstream portal invert diversion tunnel	N/A
(7)	Streambed at centerline of dam	El. 55 \pm (Outlet dam) El. 85 \pm (East End dam)
(8)	Maximum tailwater	N/A

d. Reservoir (Feet)

(1)	Length of maximum pool	8,000 \pm
(2)	Length of recreation pool	N/A
(3)	Length of flood control pool	N/A

e. Storage (Acre-Feet)

(1)	Recreation pool	4,100 \pm (at crest)
(2)	Flood control pool	N/A
(3)	Design surcharge	5,100 \pm
(4)	Top of dam	5,500 \pm

f. Reservoir Surface (Acres)

(1)	Top of dam	243 \pm
(2)	Maximum pool	239 \pm
(3)	Flood control pool	N/A
(4)	Recreation pool	N/A
(5)	Spillway crest	230

g. Dam

(1)	Type	Earthfill with concrete core
(2)	Length	Outlet - 2,190 feet East End - 180 feet
(3)	Height	Outlet - 42 feet East End - 12 feet
(4)	Top Width	Outlet - 52 feet East End - 8 feet
(5)	Side Slope	Outlet - 1-3/4:1 Upstream, Varies downstream East End - Unknown
(6)	Zoning	Unknown
(7)	Impervious Core	Unknown
(8)	Cutoff	Unknown
(9)	Grout Curtain	Unknown
(10)	Other	N/A

h. Spillway

(1)	Type	Ungated weir
(2)	Length of Weir	30 feet
(3)	Crest Elevation	El. 91 ±
(4)	Gates	None
(5)	U/S Channel	N/A
(6)	D/S Channel	N/A
(7)	General	N/A

1. Regulating Outlets. The outlet works consist of a 36-inch gravity flow line to Birch Pond and an emergency blowoff arrangement which can be directed to either Birch Pond or Hawkes Brook. The elevations of these lines are not known.

SECTION 2

ENGINEERING DATA

2.1 Design

There are some drawings of Walden Pond Outlet Dam available at the Town of Lynn City Hall (Room 401) showing the dam cross sections. Other than these drawings, which are made part of this report, there are no design data nor records available.

2.2 Construction

The Walden Pond Outlet dam was built in 1890 and raised in 1905. The spillway was built in 1930. The Walden Pond East dam was built in 1905. There are no detailed construction records available.

2.3 Operation

Some flow data are kept but are not relevant to this investigation.

2.4 Evaluation

a. Availability. Other than the drawings mentioned above, there are no engineering data available.

b. Adequacy. The lack of in-depth engineering data does not allow for a definitive review. Therefore, the adequacy of these dams, structurally and hydraulically, cannot be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and sound hydrologic and hydraulic engineering judgment.

c. Validity. N/A

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The Phase I visual inspections of the Walden Pond Outlet and East End Dams were conducted on July 6, 1978. The project is part of the water supply of the City of Lynn, releases being possible to Birch and Breeds Pond. The original Outlet Pond Dam is almost 90 years old, and was raised almost 75 years ago when the East End Dam was constructed. The projects are unprotected and obviously misused by the public.

b. Dams. Both dams are earthfill with concrete core. The downstream face of the core wall of the Outlet dam is exposed in several places due to severe erosion caused by motorbiking. While there is evidence of motorbiking on the East End Dam, the erosion is not near as severe. There is motorbiking on the crests of the dam but the situation does not appear serious.

The Outlet dam is heavily overgrown on both the up and downstream slopes. The riprap on the downstream slope is somewhat displaced in many areas but there are no obvious signs of major movement. There is some growth other than grass on the up and downstream slope of the East End dam. There is evidence that the lower portion of this low dam was riprapped at one time, however much of it has sloughed.

There are no significant misalignments of either dam, however both dams obviously suffer from lack of maintenance and supervision. The Outlet dam, owing mainly to the exposure of the core wall, must be considered to be in poor condition. The East End dam is in fair condition.

c. Appurtenant Structures. Both brick and concrete gatehouses, and the concrete control structure below the Outlet dam, are, apart from minor spalling, in good condition. The service bridges require painting. The stone-lined spillway at the Outlet dam is overgrown, contains debris and is in generally poor condition.

d. Reservoir Area. The banks surrounding the reservoir are hilly and wooded. There are no houses along the perimeter of the reservoir. There appears to be little or no possibility of landslides or conditions which might result in a sudden increase of sediment load in the reservoir.

e. Downstream Channels. In the case of the Outlet dam, the channel immediately downstream of the spillway is overgrown. Beyond that is a broad, semi-marsh. There are several homes and commercial and industrial buildings in the general watercourse below the dam, both before and after its intersection with U.S. Route 1. The exact number and identity of the structures affected would depend upon the magnitude and location of the breach.

Should a failure of the East End occur, water would flow through a thickly settled residential area.

3.2 Evaluation

The visual inspections during site examination indicate that both the Outlet and East End dams have been neglected with respect to maintenance. The Outlet dam and spillway must be considered to be in poor condition, and the East End dam to be in fair condition. The gatehouses are operable, obviously, and in good condition. The reservoir itself is not a factor in evaluating the dams. The watercourses below both dams are inhabited to the extent that property and life would be in jeopardy if the dam(s) failed.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

Walden Pond receives water from Hawkes Pond and the Ipswich River. Water level is maintained by gravity feed to Birch Pond and pumping to Breeds Pond. There is an emergency blowoff arrangement which can divert water either to Birch Pond or Hawkes Brook. Inflows in excess of these capabilities would flow over the spillway.

4.2 Maintenance of Dam

There appear to be no definite maintenance procedures of the dam in effect.

4.3 Maintenance of Operating Facilities

The gates controlling the outflows are maintained on a yearly basis, according to the owner.

4.4 Warning System

There is no warning system.

4.5 Evaluation

Apart from the daily operation to meet the water supply demands, the operational procedures are minimal. Maintenance of the dam and spillway could be improved. Recommendations for improving this situation are given in Section 7.3.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data. The hydraulic/hydrologic analysis was made in accordance with "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations", "Estimating Effect of Surcharge Storage on Maximum Probable Discharges", and "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" as furnished by the New England Division, Corps of Engineers and "Recommended Guidelines for Safety Inspection of Dams" as issued by the Department of the Army, Office of the Chief of Engineers.

U.S.G.S. Quadrangle maps were used to determine reservoir and drainage areas. Where practicable, spillway dimensions were obtained by direct measurement. Hydraulic coefficients were assigned on the basis of experience and engineering judgment.

b. Experience Data. No specific experience data with respect to the hydraulic/hydrological characteristics of the project are known to exist.

c. Visual Observations. Spillway is totally overgrown. The stone-lined channel is filled with debris. There is an emergency blowoff directional control in the low concrete structure below dam. Manhole covers are secured. Riprap on the front face is in good condition.

d. Overtopping Potential. A Probable Maximum Flood (PMF) of 1,411 cfs was determined. Owing to its intermediate size and high hazard classifications, the PMF was used to determine the Peak Outflow (or test flood) of 642 cfs. The spillway can discharge this flow with about 2 feet of freeboard remaining. Thus, the dams are not in danger of overtopping.

Assuming a 525 foot breach in the Outlet dam, a Peak Failure Flood of about 184,000 cfs was determined. Such a discharge would destroy several dwellings on the banks of the watercourse below the dam, U. S. Route 1 would be in danger of being flooded, and human life would be endangered.

Assuming a 60 foot breach in the East End dam would result in a Peak Failure Outflow of 4,200 cfs. This flow would run through a recreational area and then through a residential area before discharging into Sluice Pond which, in turn, would overflow its banks. There would be flooding, destruction of property, and possible loss of human life in such an event.

The areas of impact immediately downstream of both dams are shown on the location map.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. Nothing was noted which would indicate that the dams were unstable.
- b. Design and Construction Data. No design nor construction data are available other than a cross section of the dam.
- c. Operating Records. Not applicable.
- d. Post Construction Changes. No data concerning any post construction changes are available.
- e. Seismic Stability. The dam is located in Seismic Zone 3. Because of its configuration and condition and the low head of water retained, a seismic analysis is not considered warranted.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The condition of the Outlet dam is poor; that of the East End dam is fair.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of the dams could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.

c. Urgency. The required repair and maintenance work should be accomplished within one year of the receipt of this report by the owner.

d. Need for Additional Investigation. There is no need for additional investigation.

7.2 Recommendations. Additional engineering investigations or major modifications to the dams are not required.

7.3 Remedial Measures

a. Alternatives. Not applicable.

b. Operating and Maintenance Procedures.

- (1) All eroded areas should be filled and seeded.
- (2) The spillway should be cleaned of growth and debris and repairs made if required.
- (3) The owner of the dam should develop and implement procedures which would include annual inspection of the dams and the initiation of repairs. This should include repair of all spalled concrete and repair and painting of the service bridge and gatehouse as required.
- (4) Motorbiking on the dam should be stopped.

(5) Around the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

(6) The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT WALDEN POND OUTLET

DATE JULY 6, 1978

TIME 2:45 PM.

WEATHER WARM & SUNNY

W.S. ELEV. 915 U.S. _____ DN.S _____

PARTY:

1. J. GOODRICH

2. D. FISCHER

3. _____

4. _____

PROJECT FEATURE

INSPECTED BY

REMARKS

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLETDATE JULY 6, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u>	
Crest Elevation	97 97±
Current Pool Elevation	91±
Surface Cracks	none
Pavement Condition	no paving
Movement of Settlement of Crest	none
Lateral Movement	none
Vertical Alignment	O.K.
Horizontal Alignment	O.K.
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	none
Trespassing on Slopes	heavy growth & trees on U/S slope
Sloughing or Erosion of Slopes or Abutments	20' of exposed core wall on P/S slope
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	none
Unusual Embankment or Downstream Seepage	none
Piping or Boils	none
Foundation Drainage Features	-
Toe Drains	none
Instruments on System	

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLET

DATE JULY 6, 1978

PROJECT FEATURE

NAME

AREA EVALUATED	CONDITION
<u>CONCRETE DAM</u>	
Concrete Surfaces	
Structural Cracking	
Movement -- Horizontal & Vertical Alignment	
Junctions	
Drains -- Foundation, Joint, Face	
Water Passages	
Seepage or Leakage	
Monolith Joints -- Construction Joints	
Foundation	
	NOT APPLICABLE

3

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLETDATE JULY 6, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u></p> <p>a. Approach Channel</p> <p>Slope Conditions</p> <p>Bottom Conditions</p> <p>Rock Slides or Falls</p> <p>Log Boom</p> <p>Debris</p> <p>Condition of Concrete Lining</p> <p>Drains or Weep Holes</p> <p>b. Intake Structure</p> <p>Condition of Concrete</p> <p>Stop Logs and Slots</p>	<p>NOT APPLICABLE</p> <p>4</p>

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLETDATE JULY 6, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - TRANSITION AND CONDUIT

General Condition of Concrete

Rust or Staining on Concrete

Spalling

Erosion or Cavitation

Cracking

Alignment of Monoliths

Alignment of Joints

Numbering of Monoliths

NOT
APPLICABLE

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLETDATE JULY 6, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	<i>poor</i>
Rust or Staining	<i>some</i>
Spalling	<i>some</i>
Any Visible Reinforcing	<i>none</i>
Any Seepage or Efflorescence	<i>none</i>
Drain Holes	<i>none</i>
c. Discharge Channel	
General Condition	<i>} heavily overgrown with vegetation</i>
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLETDATE JULY 6, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - CONTROL TOWER</u></p> <p>a. Concrete and Structural</p> <p>General Condition</p> <p>Condition of Joints</p> <p>Spalling</p> <p>Visible Reinforcing</p> <p>Rusting or Staining of Concrete</p> <p>Any Seepage or Efflorescence</p> <p>Joint Alignment</p> <p>Unusual Seepage or Leaks in Gate Chamber</p> <p>Cracks</p> <p>Rusting or Corrosion of Steel</p> <p>b. Mechanical and Electrical</p> <p>Air Vents</p> <p>Float Wells</p> <p>Crane Hoist</p> <p>Elevator</p> <p>Hydraulic System</p> <p>Service Gates</p> <p>Emergency Gates</p> <p>Lightning Protection System</p> <p>Emergency Power System</p> <p>Wiring and Lighting System</p>	<p>NOT APPLICABLE</p> <p>7</p>

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLETDATE JULY 6, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND</u> <u>OUTLET CHANNEL</u> (gate House)	
General Condition of Concrete	poor
Rust or Staining	some
Spalling	some
Erosion or Cavitation	-
Visible Reinforcing	none
Any Seepage or Efflorescence	none
Condition at Joints	O.K.
Drain holes	none
Channel	
Loose Rock or Trees Overhanging Channel	N/A
Condition of Discharge Channel	N/A

INSPECTION CHECK LIST

PROJECT WALDEN POND OUTLETDATE JULY 6, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SERVICE BRIDGE</u>	
a. Super Structure	
Bearings	O.K.
Anchor Bolts	O.K.
Bridge Seat	O.K.
Longitudinal Members	O.K.
Under Side of Deck	-
Secondary Bracing	O.K.
Deck	O.K.
Drainage System	none
Railings	In Need of Repair
Expansion Joints	O.K.
Paint	In Need of Paint
b. Abutment & Piers	
General Condition of Concrete	Poor
Alignment of Abutment	O.K.
Approach to Bridge	
Condition of Seat & Backwall	O.K.

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Walden Pond East

DATE July 7, 1978

TIME 11:30AM

WEATHER WARM & SUNNY

W.S. ELEV. 91± U.S. _____ DN.S _____

PARTY:

1. J. GOODRICH
2. D. FISCHER
3. _____
4. _____
5. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

INSPECTION CHECK LIST

PROJECT WALDEN POND EASTDATE JULY 7, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u>	
Crest Elevation	<u>97±</u>
Current Pool Elevation	<u>91</u>
Surface Cracks	<u>none</u>
Pavement Condition	<u>no pavement</u>
Movement of Settlement of Crest	<u>none</u>
Lateral Movement	<u>none</u>
Vertical Alignment	<u>same OK.</u>
Horizontal Alignment	<u>O.K.</u>
Condition at Abutment and at Concrete Structures	<u>no concrete structures</u>
Indications of Movement of Structural Items on Slopes	<u>none</u>
Trespassing on Slopes	<u>none</u>
Sloughing or Erosion of Slopes or Abutments	<u>none</u>
Rock Slope Protection - Riprap Failures	<u>none</u>
Unusual Movement or Cracking at or near Toes	<u>none</u>
Unusual Embankment or Downstream Seepage	<u>none</u>
Piping or Boils	<u>none</u>
Foundation Drainage Features	<u>-</u>
Toe Drains	<u>-</u>
Instruments on System	

INSPECTION CHECK LIST

PROJECT WALDEN POND EAST

DATE July 7, 1978

PROJECT FEATURE

NAME

AREA EVALUATED	CONDITION
<u>CONCRETE DAM</u>	
Concrete Surfaces	
Structural Cracking	
Movement -- Horizontal & Vertical Alignment	
Junctions	
Drains -- Foundation, Joint, Face	
Water Passages	
Seepage or Leakage	
Monolith Joints -- Construction Joints	
Foundation	
	NOT APPLICABLE

3

INSPECTION CHECK LIST

PROJECT WALDEN POND EASTDATE JULY 7, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u></p> <p>a. Approach Channel</p> <p>Slope Conditions</p> <p>Bottom Conditions</p> <p>Rock Slides or Falls</p> <p>Log Boom</p> <p>Debris</p> <p>Condition of Concrete Lining</p> <p>Drains or Weep Holes</p> <p>b. Intake Structure</p> <p>Condition of Concrete</p> <p>Stop Logs and Slots</p>	<p>NOT APPLICABLE</p> <p>4</p>

INSPECTION CHECK LIST

PROJECT WALDEN POND EAST

DATE JULY 7, 1978

PROJECT FEATURE

NAME _____

AREA EVALUATED	CONDITION
<u>CUTLET WORKS - TRANSITION AND CONDUIT</u> General Condition of Concrete Rust or Staining on Concrete Spalling Erosion or Cavitation Cracking Alignment of Monoliths Alignment of Joints Numbering of Monoliths	NOT APPLICABLE

5

INSPECTION CHECK LIST

PROJECT WALDEN POND EASTDATE JULY 7, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u></p> <p>a. Approach Channel</p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Approach Channel</p> <p>b. Weir and Training Walls</p> <p>General Condition of Concrete</p> <p>Rust or Staining</p> <p>Spalling</p> <p>Any Visible Reinforcing</p> <p>Any Seepage or Efflorescence</p> <p>Drain Holes</p> <p>c. Discharge Channel</p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Channel</p> <p>Other Obstructions</p>	<p><i>NOT APPLICABLE</i></p> <p>6</p>

INSPECTION CHECK LIST

PROJECT WALDEN POND EASTDATE JULY 7, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - CONTROL TOWER</u></p> <p>a. Concrete and Structural</p> <p>General Condition</p> <p>Condition of Joints</p> <p>Spalling</p> <p>Visible Reinforcing</p> <p>Rusting or Staining of Concrete</p> <p>Any Seepage or Efflorescence</p> <p>Joint Alignment</p> <p>Unusual Seepage or Leaks in Gate Chamber</p> <p>Cracks</p> <p>Rusting or Corrosion of Steel</p> <p>b. Mechanical and Electrical</p> <p>Air Vents</p> <p>Float Wells</p> <p>Crane Hoist</p> <p>Elevator</p> <p>Hydraulic System</p> <p>Service Gates</p> <p>Emergency Gates</p> <p>Lightning Protection System</p> <p>Emergency Power System</p> <p>Wiring and Lighting System</p>	<p><i>NOT APPLICABLE</i></p> <p>7</p>

INSPECTION CHECK LIST

PROJECT WALDEN POND EASTDATE JULY 7, 1978

PROJECT FEATURE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - OUTLET STRUCTURE AND
OUTLET CHANNEL

General Condition of Concrete .

Rust or Staining

Spalling

Erosion or Cavitation

Visible Reinforcing

Any Seepage or Efflorescence

Condition at Joints

Drain holes

Channel

Loose Rock or Trees Overhanging
Channel

Condition of Discharge Channel

*NOT
APPLICABLE*

INSPECTION CHECK LIST

PROJECT WALDEN POND EASTDATE JULY 7, 1978

PROJECT FEATURE _____

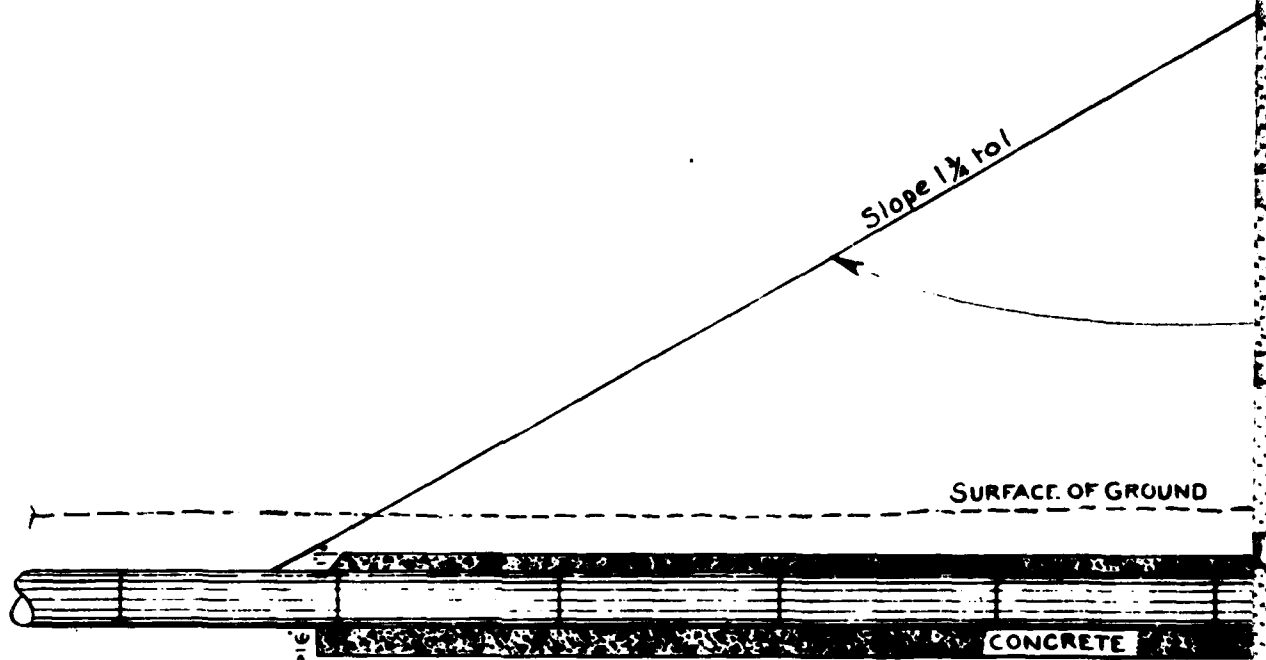
NAME _____

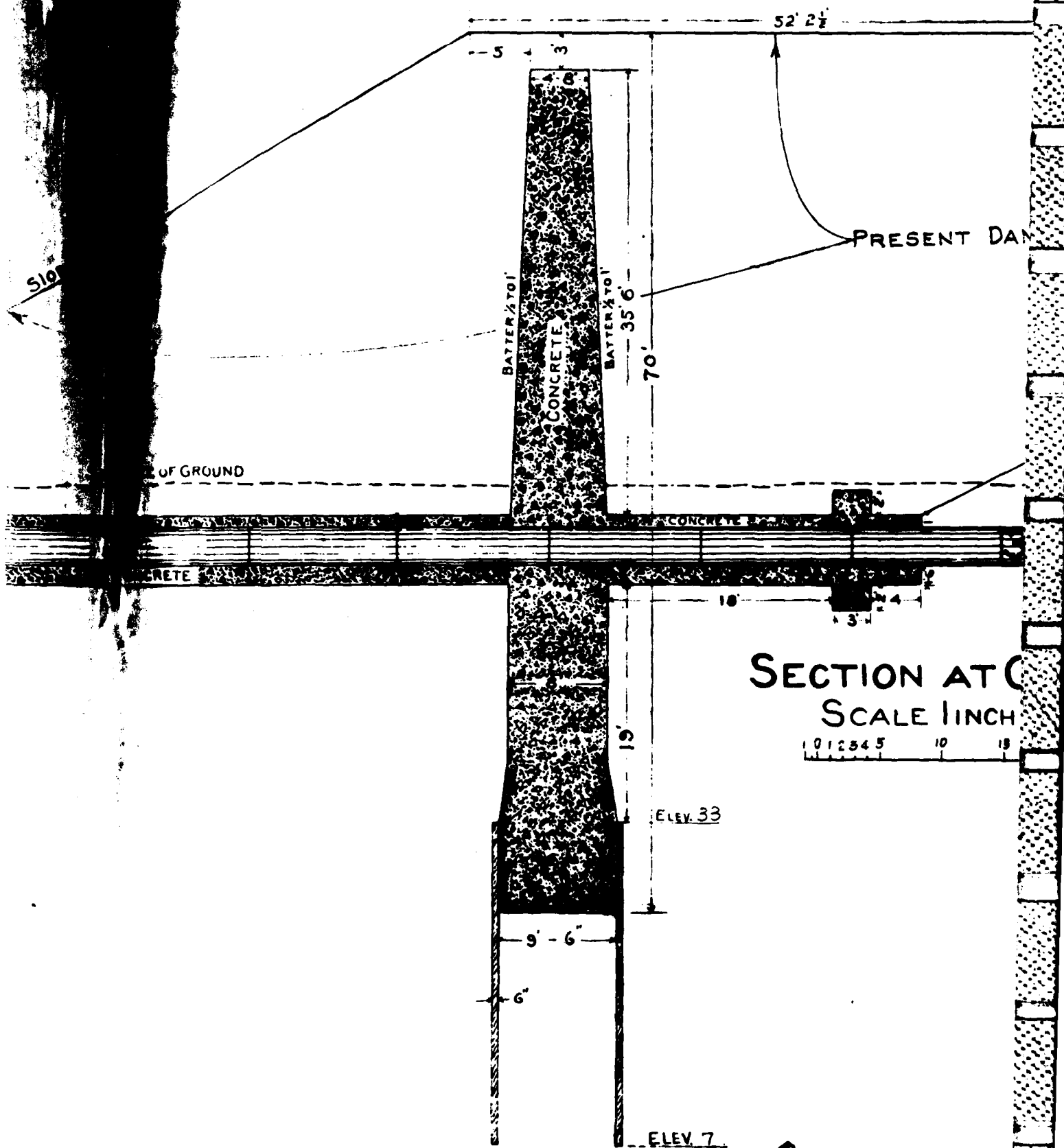
AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SERVICE BRIDGE</u></p> <p>a. Super Structure</p> <p>Bearings</p> <p>Anchor Bolts</p> <p>Bridge Seat</p> <p>Longitudinal Members</p> <p>Under Side of Deck</p> <p>Secondary Bracing</p> <p>Deck</p> <p>Drainage System</p> <p>Railings</p> <p>Expansion Joints</p> <p>Paint</p> <p>b. Abutment & Piers</p> <p>General Condition of Concrete</p> <p>Alignment of Abutment</p> <p>Approach to Bridge</p> <p>Condition of Seat & Backwall</p>	<p>NOT APPLICABLE</p> <p>9</p>

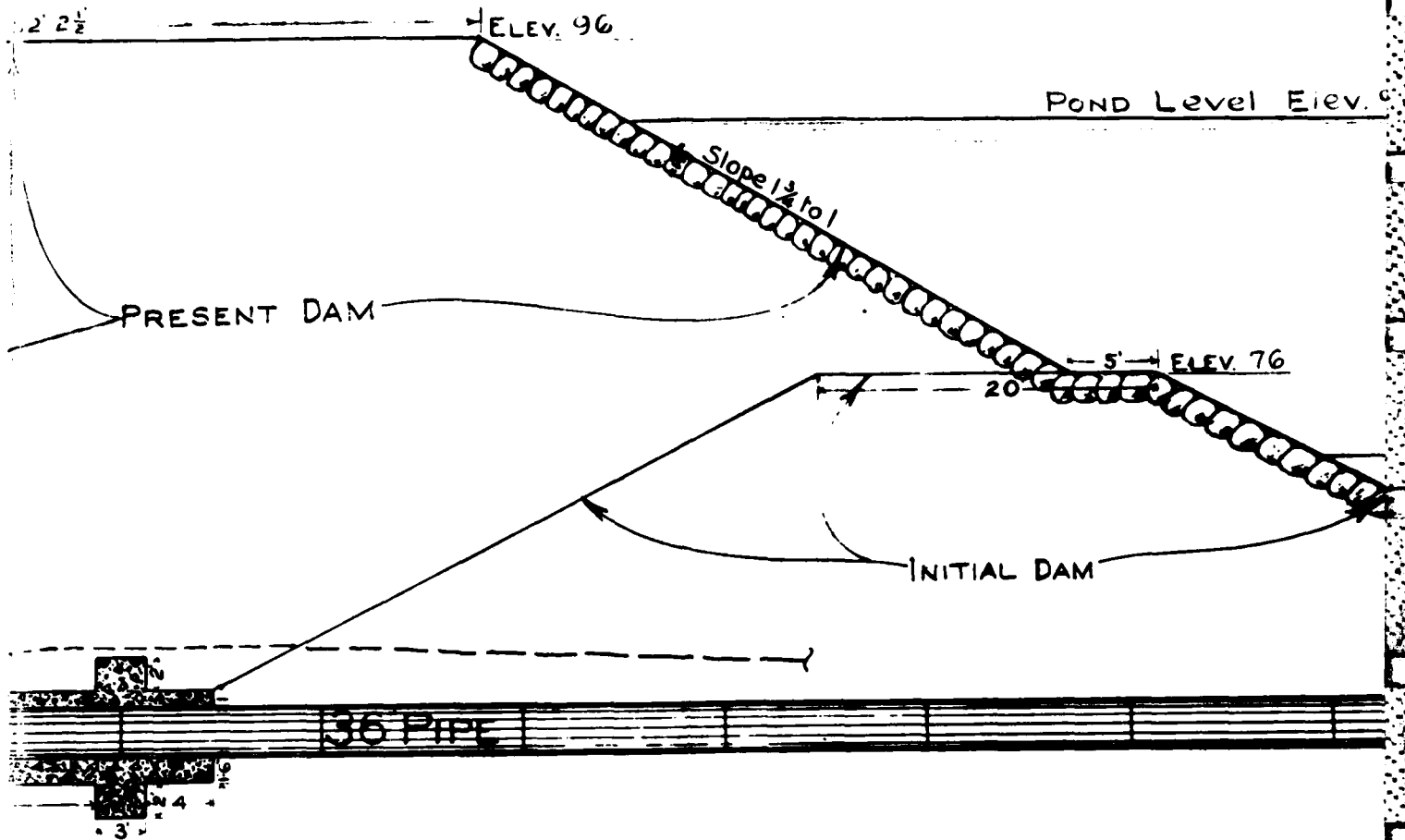
APPENDIX B

Only a few drawings were available.

Excerpts from these drawings follow.



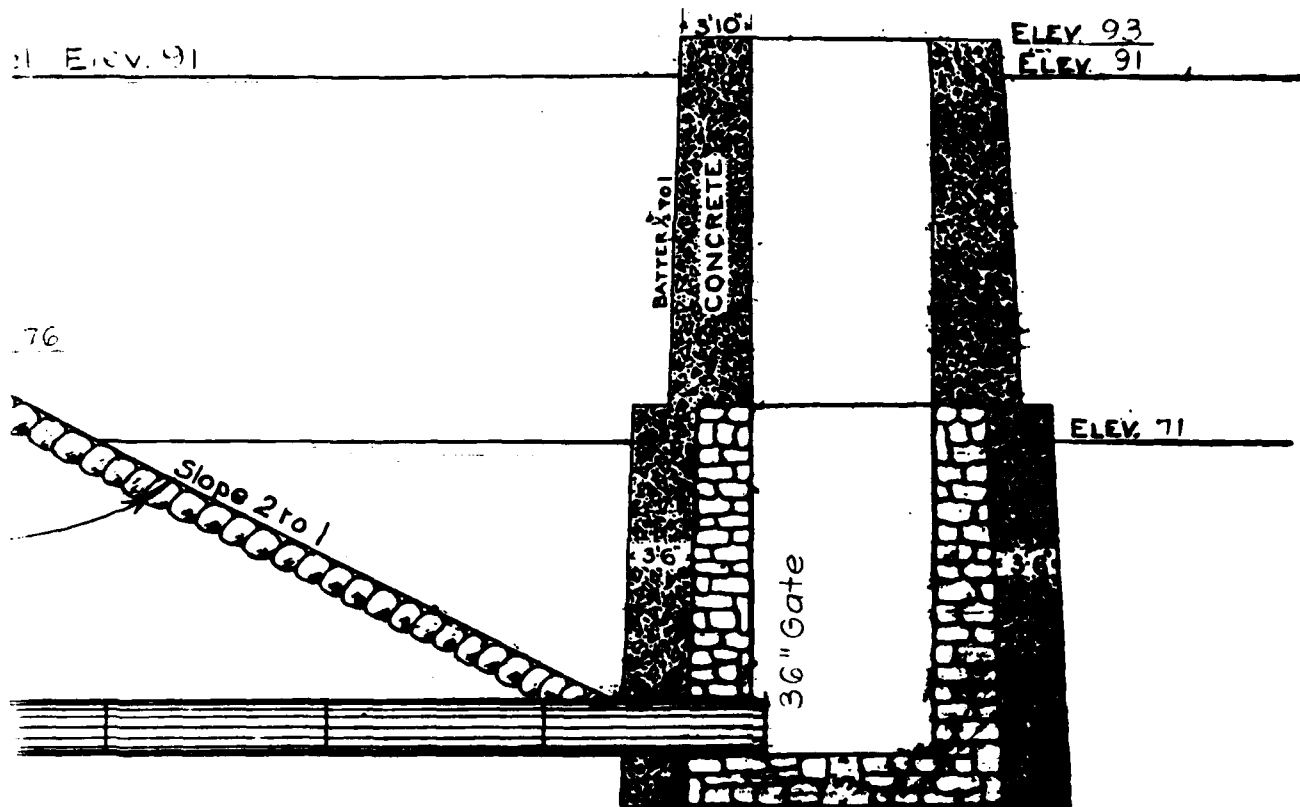




SECTION AT GATE-HOUSE

SCALE 1 INCH = 8 FEET

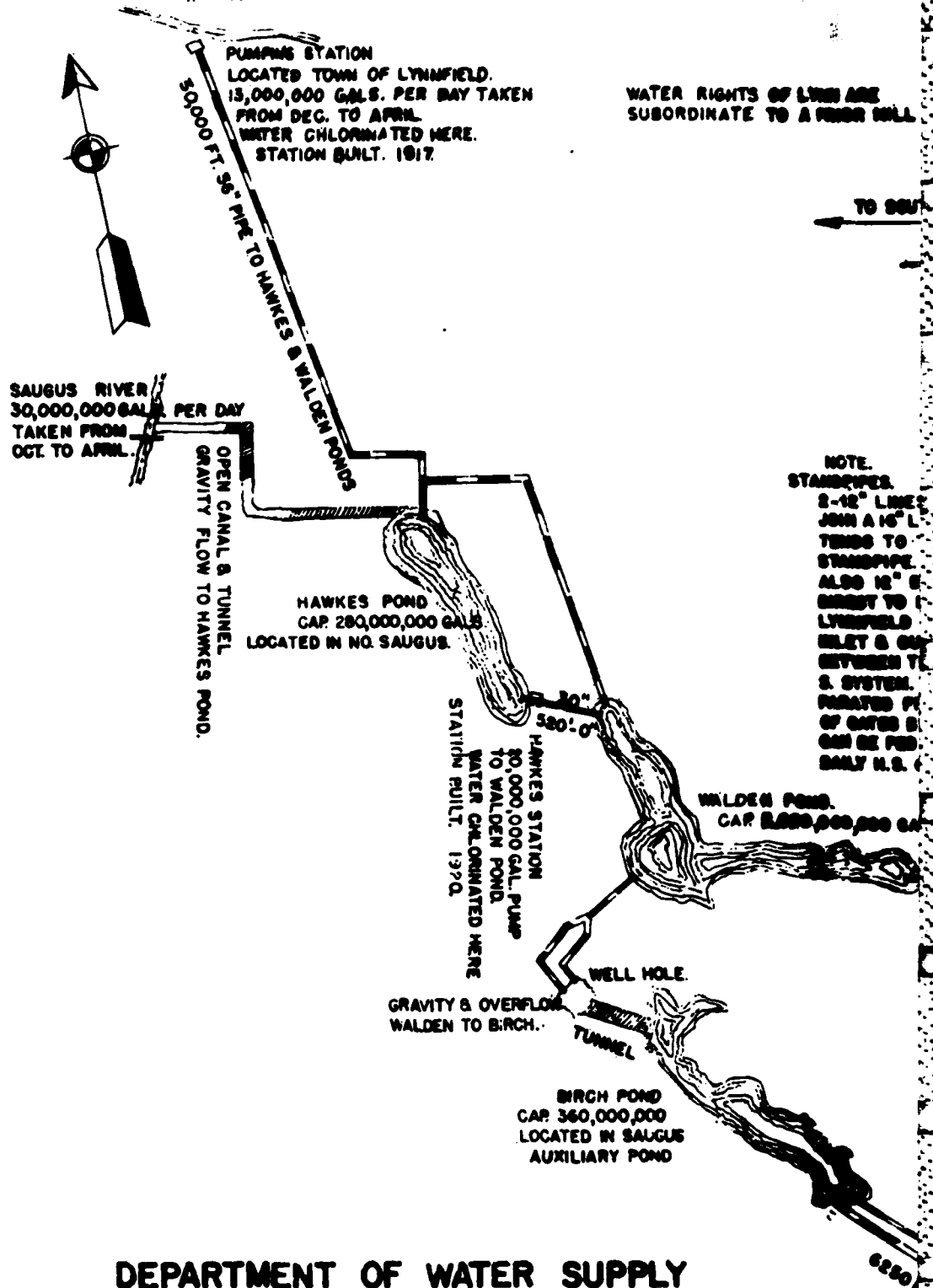




WALDEN POND

4

REPRODUCED AT GOVERNMENT EXPENSE

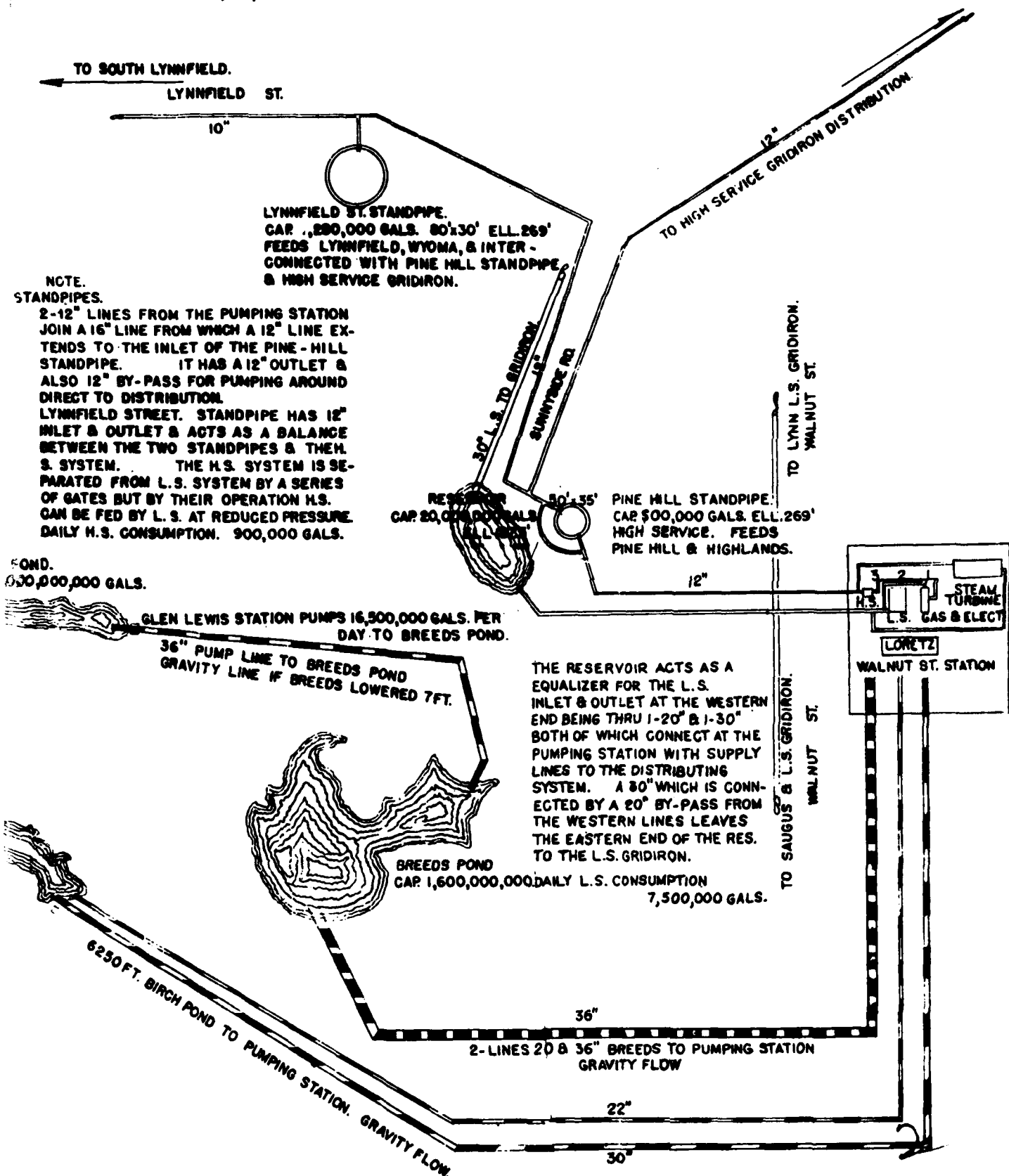


DEPARTMENT OF WATER SUPPLY CITY OF LYNN

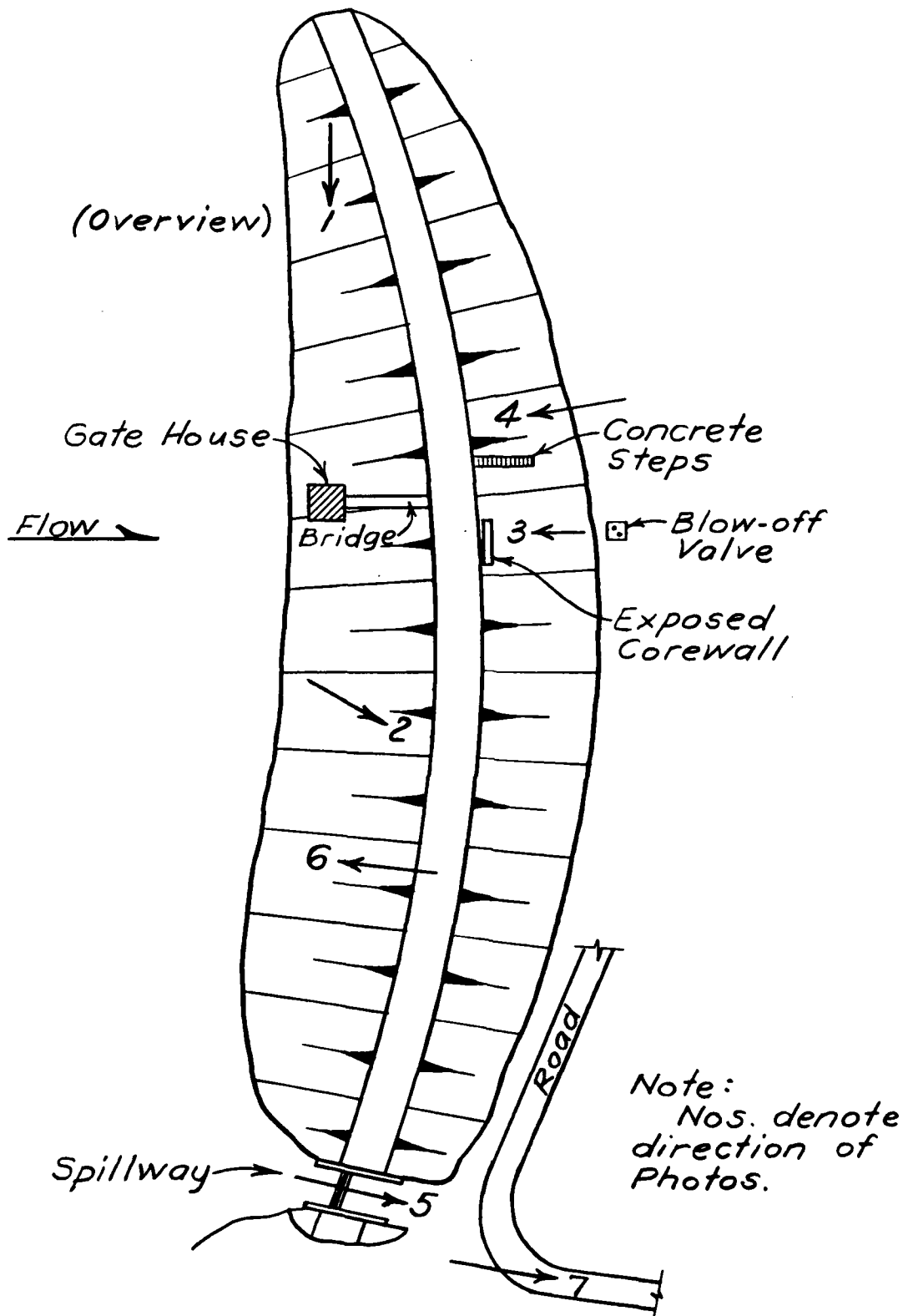
THOMAS W. HEATH, COMMISSIONER.

OPERATION OF SUPPLY SYSTEM
1940

IF LYNN ARE
D A PRIOR WILL RIGHT TO 10,000,000 GALS. PER DAY.



APPENDIX C



PLAN
WALDEN POND OUTLET



2

Overgrown Upstream Face



3

Eroded Path on Downstream Face

WALDEN POND OUTLET



4

Exposed Corewall



5

Heavily Overgrown and Strewn Spillway

WALDEN POND OUTLET



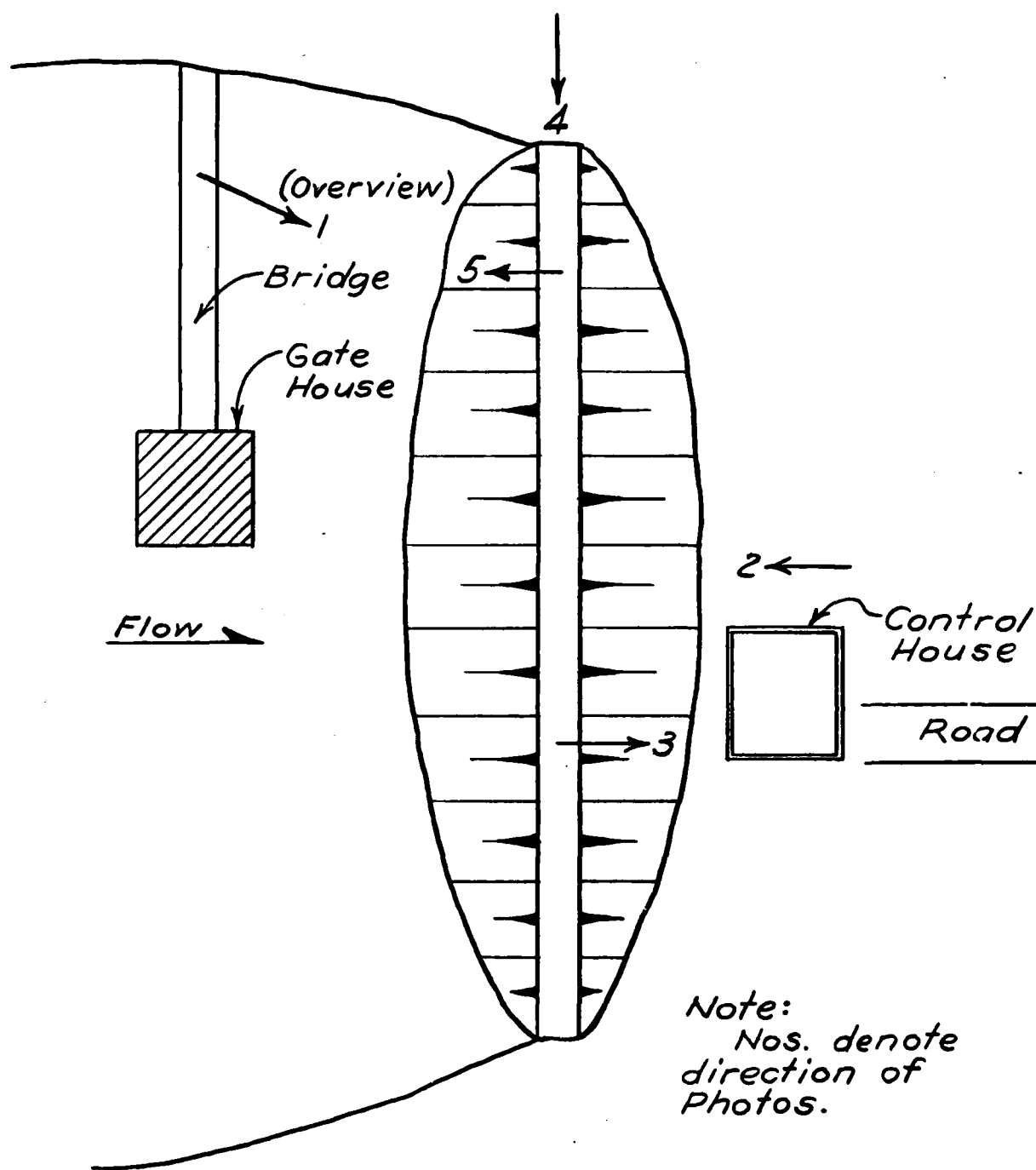
6

General View of Reservoir



7

Spillway Discharge into Road Area



Note:
Nos. denote
direction of
Photos.

PLAN

WALDEN POND EAST END



2

Downstream Face of Dam



3

Looking Downstream of Dam

WALDEN POND EAST END

REPRODUCED AT GOVERNMENT EXPENSE



4

Looking Across Crest of Dam from Left Bank



5

Looking West from Dam

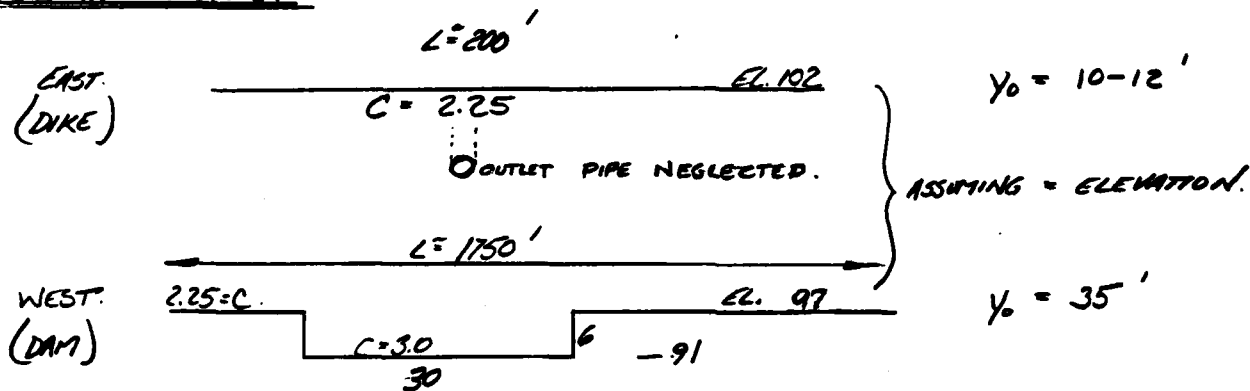
WALDEN POND EAST END

APPENDIX D

Client C of E Job No. 1345-065 Sheet 1 of 11
 Subject WALDEN POND (EAST & WEST) By J. VEITCH Date 11 AUG. 1978
 Ckd. _____ Rev. _____

PMF = 1411 cfs
 DRAINAGE AREA: $1.75 \text{ mi}^2 = 1120 \text{ AC}$
 RESERVE AREA = 230 AC.

SPILLWAY RATING.



USGS QUAD SHEETS SHOW DAM TO BE $< 100'$ ELEVATION BUT ON INSPECTION DAM & DIKE APPEAR $> 100'$

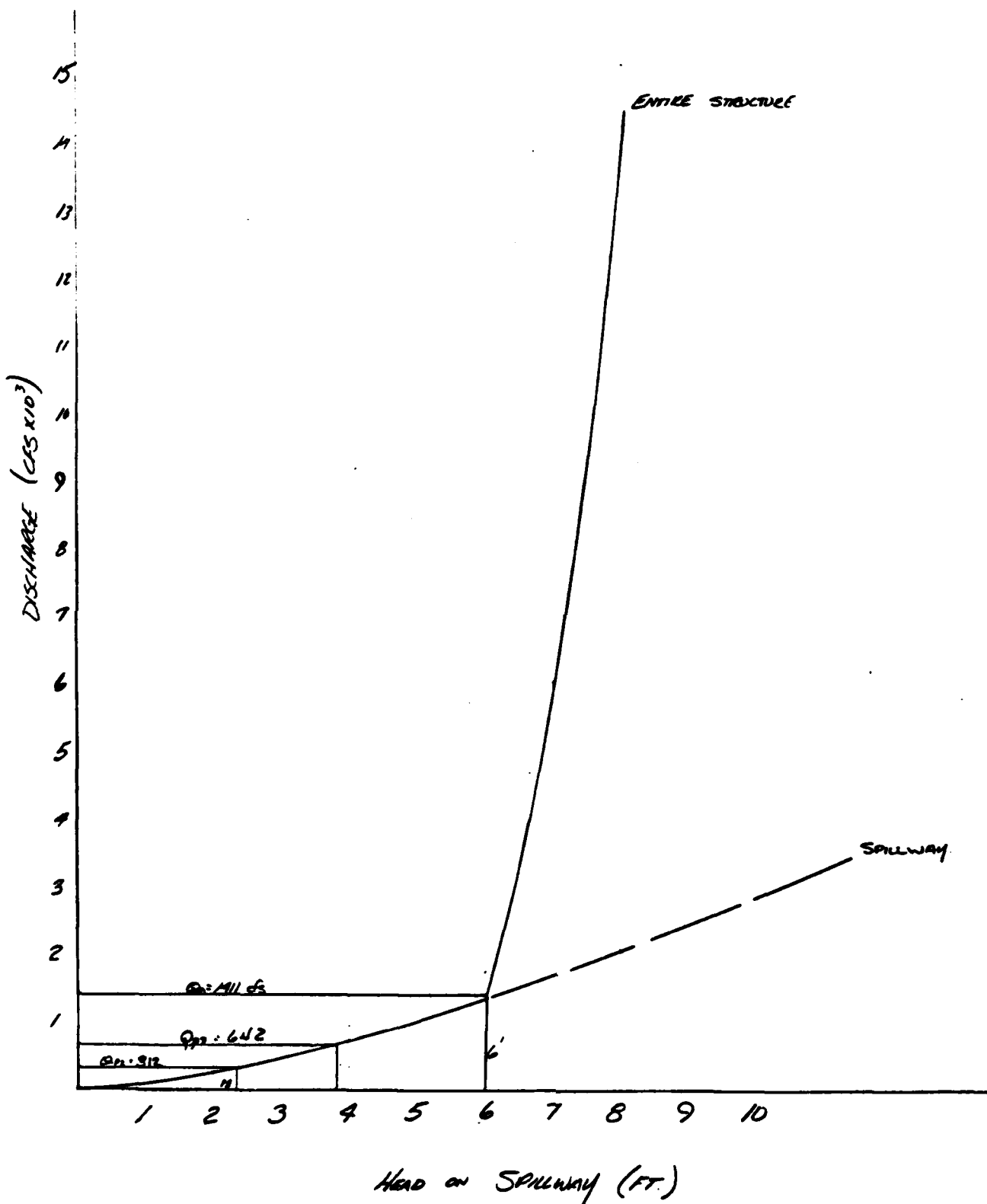
RATING CURVE

SURCHARGE CALCULATED ON TOTAL BUT INDIVIDUAL DISCHARGES CONSIDERED TO APPROPRIATE CHANNELS. FAILURE CALCULATED I.: EAST FAILURE AND II: WEST CALCULATED.

RATING.

<u>H₂</u>	<u>Q_{WEST}</u>	<u>Q_{EAST}</u>	<u>Q_{TOTAL}</u>
2	255		255
4	720		720
6	1323		1323
8	2036 + 10,945	1273	14,254

Client C of E Job No. 1345-065 Sheet 2 of 11
 Subject WALDEN - (EAST & WEST) By J. VEITCH Date 11 AUG. 1978
 Ckd. _____ Rev. _____



Client C&E Job No. 1345-065 Sheet 3 of 11
 Subject WALDEN POND (EAST & WEST) By J. VETTON Date 11 AUG. 1978
 Ckd. _____ Rev. _____

$Q_{P1} = 1411 \text{ cfs}$ $S = 6.0'$ (FLOW CONTAINED WITHIN SPILLWAY)

$STOR_1 = \frac{(6.0)(12)(230)}{1120} = 14.8''$

$Q_{P2} = 1411(1 - \frac{19.8}{19}) = 312 \text{ cfs}$ $S_2 = 2.4'$ $STOR_2 = \frac{2.4(12)(230)}{1120} = 5.9''$ $STOR_{AV} = 10.35''$

$Q_{P3} = 1411(1 - \frac{10.35}{19}) = 642 \text{ cfs}$

\therefore TEST FLOOD CASE I : INVESTIGATION OF 642 cfs through SPILLWAY ON WEST OUTLET.

PEAK FAILURE CASE I : FAILURE EAST DIKE P.F.O. Exclusively (No Spillage)

PEAK FAILURE CASE II : " WEST DAM. & CAPACITY OF SPILLWAY

P.F.O. CASE I EAST DIKE

$Q_{P1} = \frac{8}{27} (60)(132.2)(12)^{1.5}$

$= 4,194 \text{ cfs}$

$y_0 = 12'$
 $w_b = .3(200) = 60'$

P.F.O. CASE II WEST DAM

$y_0 = 35'$
 $w_b = .3(1750) = 525'$

$Q_{P1} = \frac{8}{27} (525)(132.2)(35)^{1.5}$

$\cdot 182,775 \text{ cfs} + 642 \text{ cfs} = \underline{184,000 \text{ cfs}}$

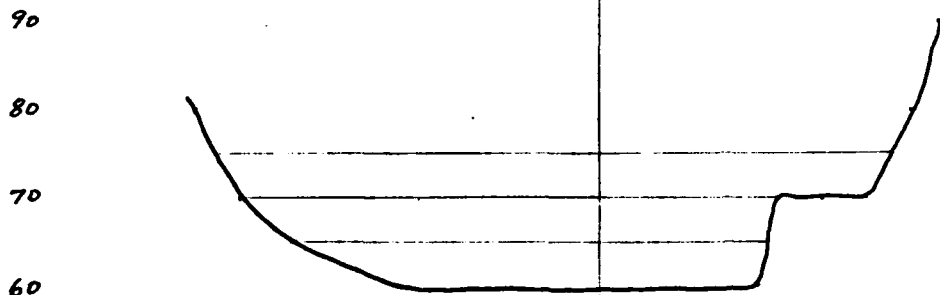
Client COFE Job No. 1345-065 Sheet 4 of 11
Subject WALDEN POND - (WEST) By J. VEITEN Date 11 AUG. 1978
Ckd. _____ Rev. _____

CRITICAL CASE P.F.O. CASE II.

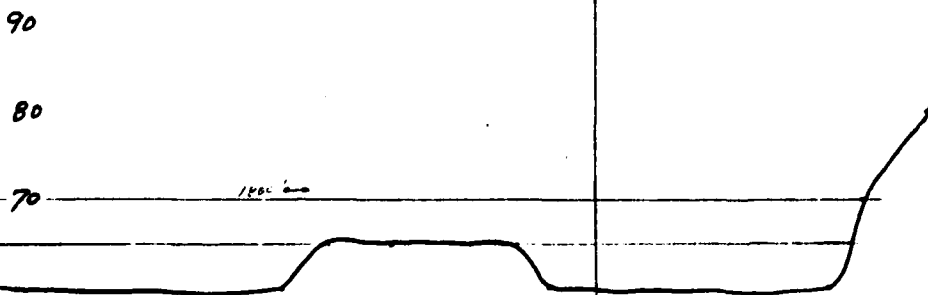
REACH I DAM

WEST.

SECTION I. BASE OF DAM.



SECTION II 700'



Client C of E Job No. 1345-065 Sheet 5 of 11
 Subject WALDEN Pond. WEST By J VEITEN Date 11 AUG 1978
 Cld. _____ Rev. _____

SECTION I	A	EA	WP.
EL. 60	-	-	800
65	4650	4650	1060
70	5650	10300	1200

II

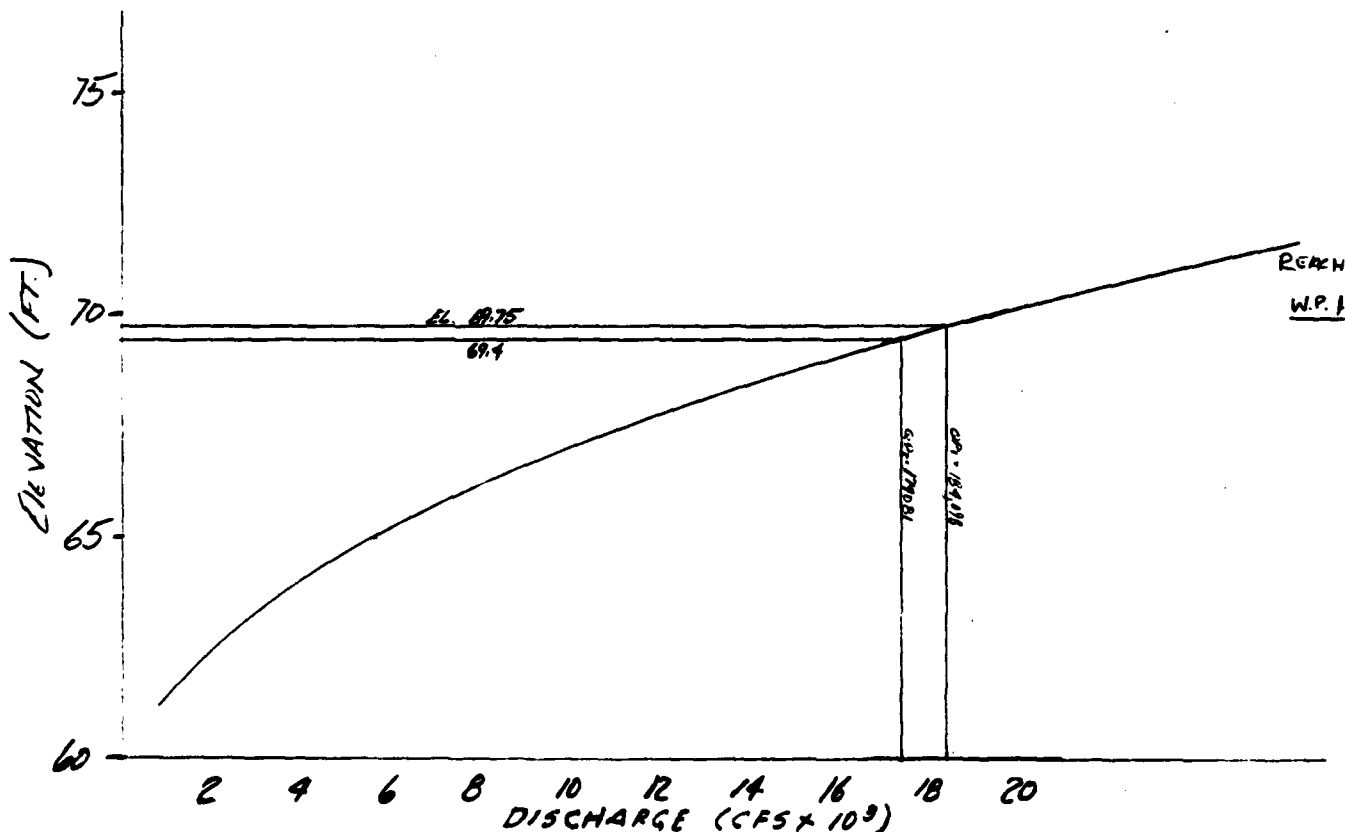
60	-	-	1230
65	7375	7375	1720
70	10300	17675	2400

RATINGS

$$n = .03 \quad S = \frac{10}{2100} = .005$$

$$Q = \frac{1.49}{.03} (6013) \left(\frac{6013}{1390} \right)^{4.7} \sqrt{.005} = 56340$$

$$Q = \frac{1.49}{.03} (13986) \left(\frac{13986}{1800} \right)^{4.7} \sqrt{.005} = 194060$$

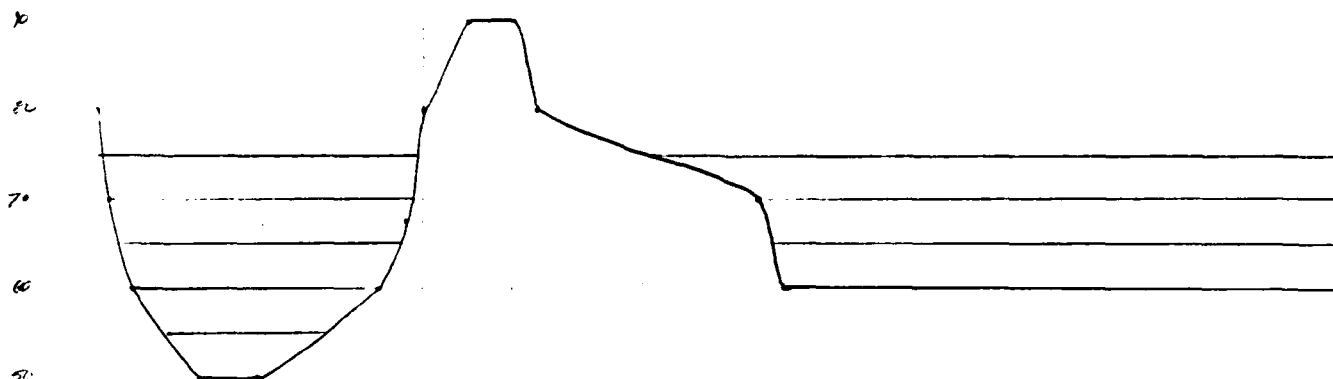


Client C of E
 Subject WALDEN POND

Job No. 1345-065 Sheet 6 of 11
 By J. VEITCH Date 17 Aug 1978
 Ckd. _____ Rev. _____

SECTION III.

750'



SECTION III. EL.	A.	EA	W.P.
50	-	-	130
55	1225	1225	360
60	2275	3500	550
65	9825	13325	2030
70	10375	23700	2120

$S = .007$

$n = .03$

$$55 - Q = \frac{1.49}{.03} (1225) \left(\frac{1225}{360} \right)^{.67} \sqrt{.007} = 11,560 \text{ cfs.}$$

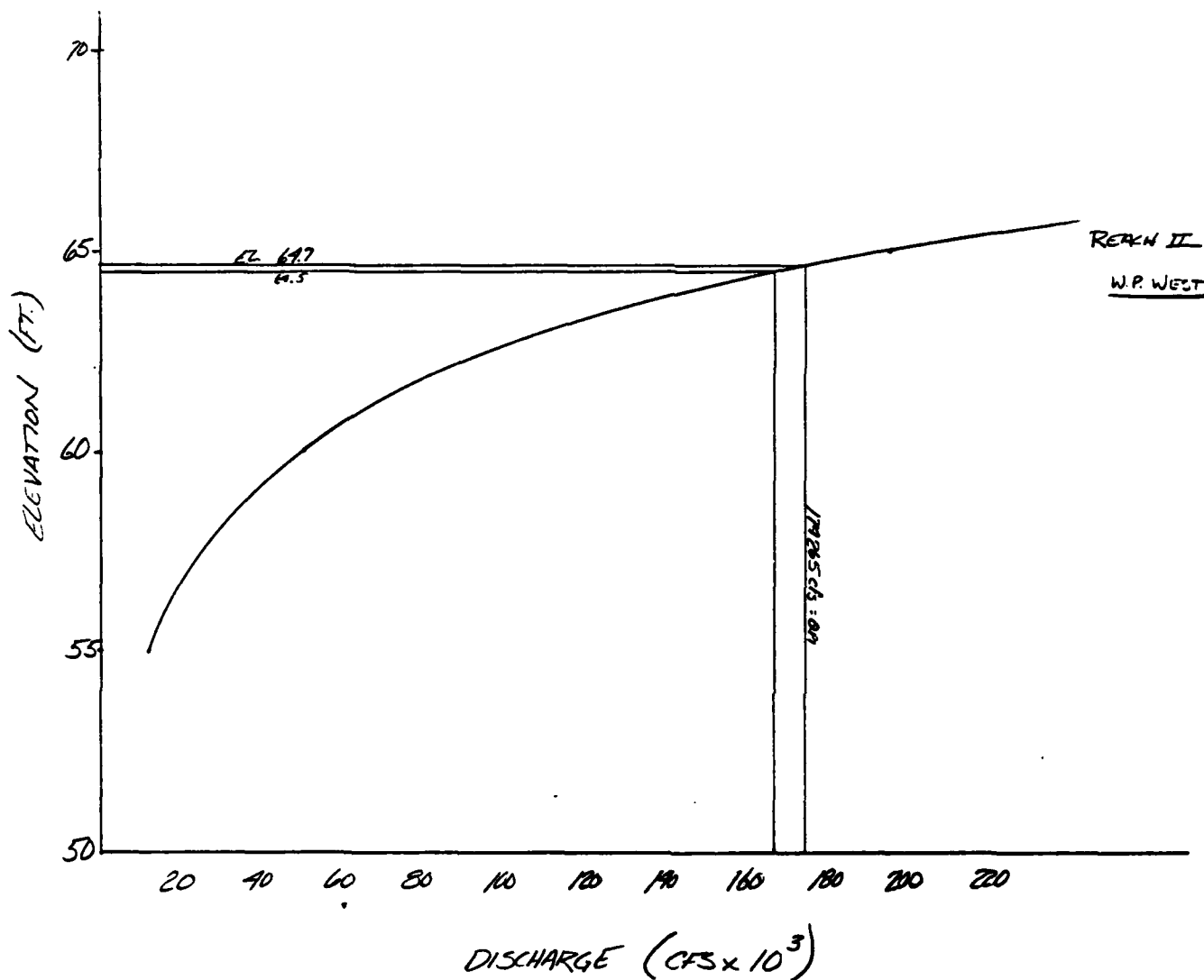
$$60 - Q = \frac{1.49}{.03} (3500) \left(\frac{3500}{550} \right)^{.67} \sqrt{.007} = 50,250$$

$$65 - Q = \frac{1.49}{.03} (13325) \left(\frac{13325}{2030} \right)^{.67} \sqrt{.007} = 195,340$$

$$70 - Q = \frac{1.49}{.03} (23700) \left(\frac{23700}{2120} \right)^{.67} \sqrt{.007} = 496,360$$

Client COFE
 Subject WALDEN POND. (WEST)

Job No. 1345-065 Sheet 7 of 11
 By J. VEITCH Date 11 AUG. 1978
 Ckd. _____ Rev. _____



CRITICAL CASE II P.F.O. WEST.

$$Q_{P1} = 184,098 \text{ cfs} \quad \text{EL. REACH I} = 69.75'$$

$$S = 35(230).5 = 4025 \text{ ACFT.}$$

$$V_1 = \frac{9.75}{10.0} \left(\frac{13988}{43560} \right) 700 = 219 \text{ AC FT}$$

$$Q_{P2} (\text{TRIAL}) = 184098 \left(1 - \frac{219}{4025} \right) = 174,081 \text{ cfs.}$$

$$V_2 = \frac{9.75}{9.75} (219) = 211 \text{ AC FT} \quad V_{\text{AVE}} = 215 \text{ AC FT}$$

$$Q_{P3} = 184098 \left(1 - \frac{215}{4025} \right) = 174265 \text{ cfs.}$$

Client COFEJob No. 1345-065 Sheet 8 of 11Subject WALDEN POND (WEST)By J. VETTER Date 12 AUG. 1978

Ckd. _____

Rev. _____

REACH #2 $Q_{P1} = 174,265 \text{ cfs.}$ $EL. = 64.7$

$$V_1 = \frac{14.7}{15} \left(\frac{10350 \times 750}{13560} \right) = 175 \text{ AC FT.}$$

$$Q_{P2(\text{TRIAL})} = 174265 \left(1 - \frac{175}{4025} \right) = 166,688 \text{ cfs}$$

$$V_2 = \frac{14.5}{14.7} (175) = 173 \text{ AC FT} \quad V_{\text{AVE.}} = 174 \text{ AC FT.}$$

$$Q_{P3} = 174265 \left(1 - \frac{174}{4025} \right) = 166,731 \text{ cfs.}$$

CASE I. $Q_i = 4194$ $EL. = 84.5$ REACH #1

$$V_1 = \frac{4.5}{5} \left(\frac{1650 \times 600}{13560} \right) = 20.5 \text{ AC FT} \quad Q_{P2(\text{TRIAL})} = 4194 \left(1 - \frac{20.5}{4025} \right) = 4172$$

NEGLECTING STORAGE REACH #1

 $Q_{i1} = 4194$ $EL. = 83.0$ REACH #2

Client C O F EJob No. 1345-065 Sheet 9 of 11Subject WALDEN (EAST)By J VETIN Date 18 AUG. 1978

Ckd. _____ Rev. _____

REACH
RATING CURVESI $S = .017$
 $N = .03$

$$85 \quad Q = \frac{1.49}{.03} (356) \left(\frac{356}{110} \right)^{.67} (.017)^{1/2} = 5064 \text{ cfs.}$$

$$90 \quad Q = \frac{1.49}{.03} (1038) \left(\frac{1038}{198} \right)^{.67} (.017)^{1/2} = 20900$$

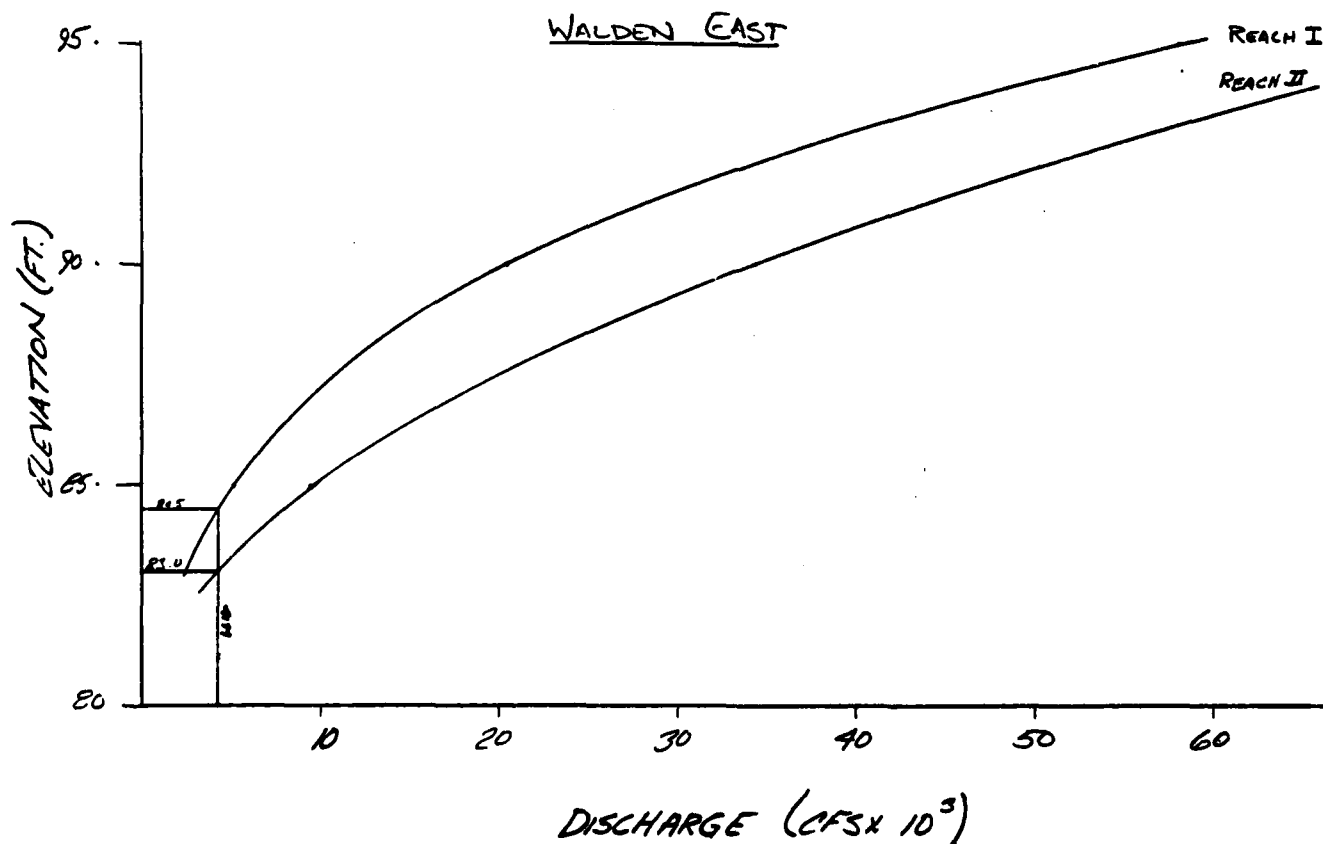
$$95 \quad Q = \frac{1.49}{.03} (2233) \left(\frac{2233}{280} \right)^{.67} (.017)^{1/2} = 58120$$

 $S = .002$
 $N = .03$

$$85 \quad \text{II.} \quad Q = \frac{1.49}{.03} (1650) \left(\frac{1650}{403} \right)^{.67} (.002)^{1/2} = 9425 \text{ cfs}$$

$$90 \quad Q = \frac{1.49}{.03} (3940) \left(\frac{3940}{513} \right)^{.67} (.002)^{1/2} = 34300$$

$$95 \quad Q = \frac{1.49}{.03} (6753) \left(\frac{6753}{613} \right)^{.67} (.002)^{1/2} = 74860$$



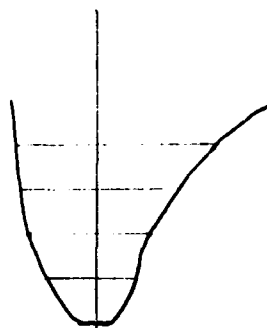
Client C of E Job No. 1345-065 Sheet 10 of 11
 Subject WALDEN POND (EAST) By J. VEITCH Date 18 AUG. 1878.
 Ckd. _____ Rev. _____

SECTION I

110

100

90



SCALE 1" = 100' →
1" = 20' ↓

	A.	E. A	W. P.
90	-	-	70
95	675	675	200
100	1175	1850	270
105	1550	3400	350

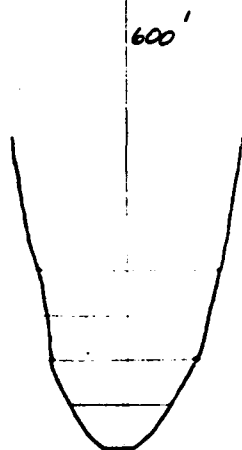
SECTION II

110

100

90

80



80	-	-	65
85	713	713	220
90	1363	2076	325
95	1713	3790	360

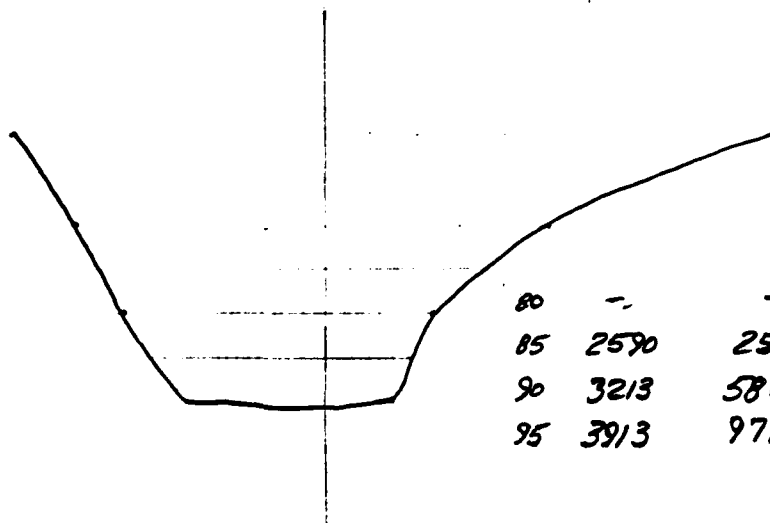
SECTION III

110

100

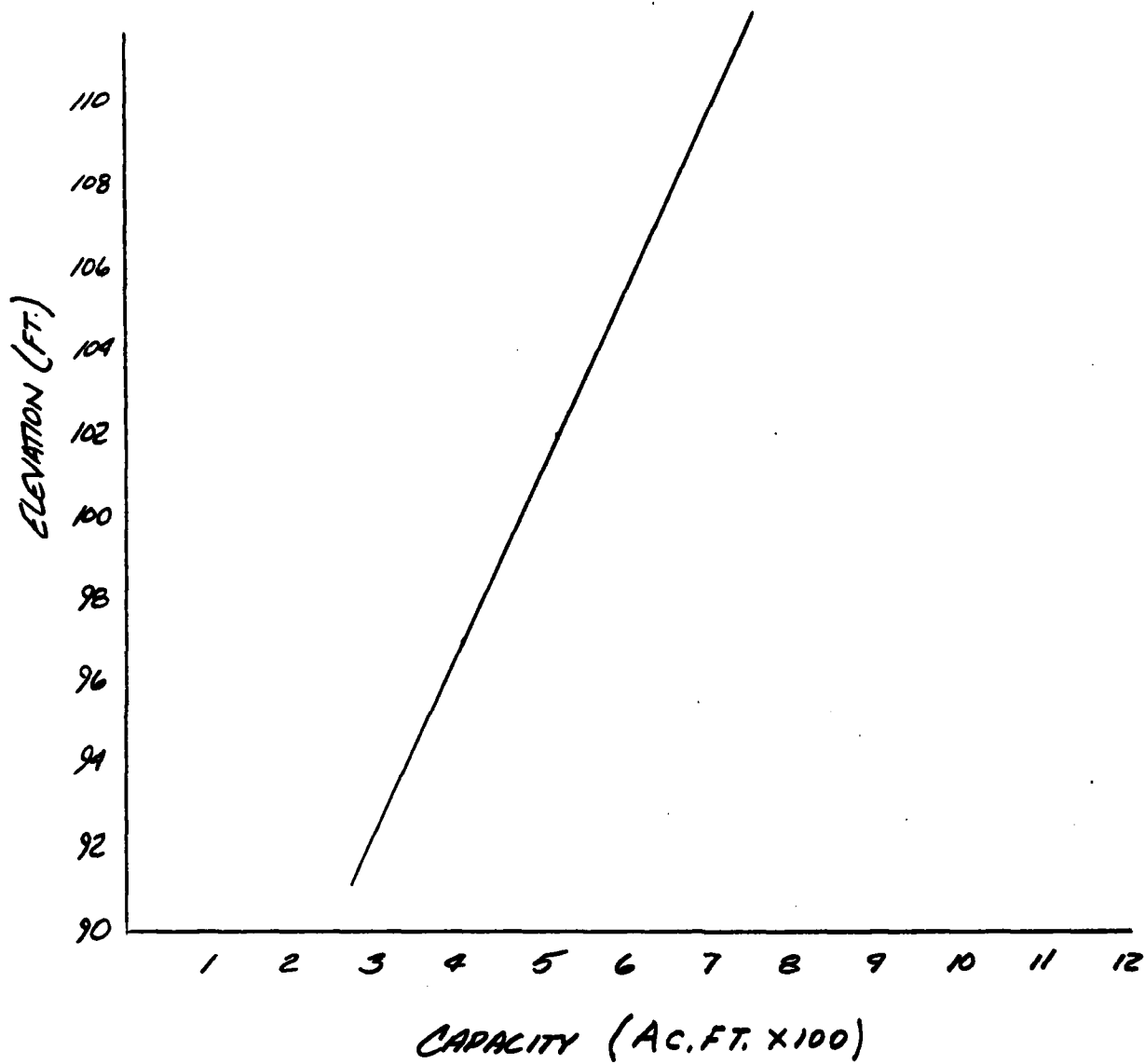
90

80



80	-	-	450
85	2590	2590	585
90	3213	5803	700
95	3913	9716	865

Client C of E Job No. 1345-065 Sheet 11 of 11
Subject WALDEN POND By J. VEITCH Date 25 AUG. 1978
CAPACITY CURVE Ctd. Rev.



APPENDIX E

END

FILMED

7-85

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